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Motor Weakness after Caudal Epidural Injection Using the Air-acceptance Test

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Air injected into the epidural space may spread along the nerves of the paravertebral space. Depending on the location of the air, neurologic complications such as multiradicular syndrome, lumbar root compression, and even paraplegia may occur. However, cases of motor weakness caused by air bubbles after caudal epidural injection are rare. A 44-year-old female patient received a caudal epidural injection after an air-acceptance test. Four hours later, she complained of motor weakness in the right lower extremity and numbness of the S1 dermatome. Magnetic resonance imaging showed no anomalies other than an air bubble measuring 13 mm in length and 0.337 ml in volume positioned near the right S1 root. Her symptoms completely regressed within 48 hours. (Korean J Pain 2013; 26: 286-290)

Key Words:
caudal epidural block, complications, epidural air, epidural injection.

Injection of local anesthetics or steroids into the epidural space through the caudal approach is a widely used and effective method for treating chronic benign pain syndromes, such as chronic axial pain, discogenic pain, spinal stenosis, and postsurgery syndrome [1]. Caudal epidural injection is a relatively safe and simple procedure with a low risk of inadvertent dural puncture, and it can also be safely used for postsurgery syndrome patients [1]. Successful caudal epidural injection requires correct evaluation of the needle position which can be achieved by injecting a small amount of air and noting any bulging or crepitus of the tissues overlying the sacrum or over-resistance of the plunger. A test aspiration must also be done to rule out vessel puncture [2]. Despite these efforts, complications such as local anesthetic toxicity, hematoma, ecchymosis of the puncture site, infection, urinary retention, and incontinence may follow. However, neurologic complications due to caudal epidural injection are known to be very rare. When complications do occur, they usually result from surgical trauma or an underlying neurologic lesion [2].

Herein, we report a case of unilateral motor weakness

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in the right leg and numbness in the S1 dermatome area as a possible consequence of a small volume of trapped air from the caudal epidural injection.

CASE REPORT

The patient, a 44-year-old female with a weight of 48 kg, height of 158 cm, and no significant medical history or underlying condition was admitted to the orthopedic ward for low back pain. Despite admission and conservative treatment, her pain failed to subside and she was referred to our pain clinic. However, she had no symptoms of radiculopathy of the lower extremities. Vital signs upon admission were within the normal range, with a blood pressure of 110/70 mmHg, a heart rate of 74 beats per minute, and oxygen saturation of 98%. Chest X-ray, electrocardiogram, complete blood cell count, blood chemistry, prothrombin time, activated partial thromboplastin time, and other laboratory findings revealed no abnormalities. Nevertheless, the patient could not walk straight for 200 meters due to her low back pain. A physical examination showed a local tenderness around the L4, L5, and S1 vertebrae, but the straight leg raising (SLR) test showed negative results. Motor and sensory functions were fully intact, and defecation and urination were normal, as well. L-spine magnetic resonance imaging (MRI) showed mild bulging of the intervertebral discs from L3 through L5.

To relieve her symptoms, she received a caudal epidural injection. Local anesthesia was given around the puncture site with 3 ml of 2% lidocaine. Then, a 20-gauge spinal needle was inserted 2 cm inwards, and 1 ml of air was injected which checking for any bulging or crepitus of the tissues overlying the sacrum or over-resistance of the plunger. Resistance was present; thus, the needle was advanced 0.5 cm farther. Then, 1 ml of air was re-injected, and the loss of resistance was confirmed. No blood was aspired, confirming negative vessel puncture. In total, 2 ml of air were used during the procedure. After correctly positioning the needle, 15 ml of 0.3% mepivacaine and 20 mg of triamcinolone were injected.

Ten minutes later, the patient felt numbness in both legs and muscle weakness in the right lower leg. Decreased motor and sensory function failed to resolve spontaneously in the right lower leg and continued to persist for 1 hour. Specifically, sensory function, which was checked at the posterolateral side of the right lower leg and the plantar area of the right foot, decreased to just 20/100 compared to the corresponding areas of the normal left leg. With regard to decreased muscle strength, flexion and extension of the right knee was normal, but at the right ankle, dorsiflexion was marked as motor grade IV and plantar flexion as motor grade I. Vital signs were within the normal range, with a blood pressure of 120/80 mmHg, a heart rate of 78 beats per minute, and oxygen saturation of 98%. Close observation was done for the next 4 hours, but the symptom persisted, making the patient anxious. To rule out the

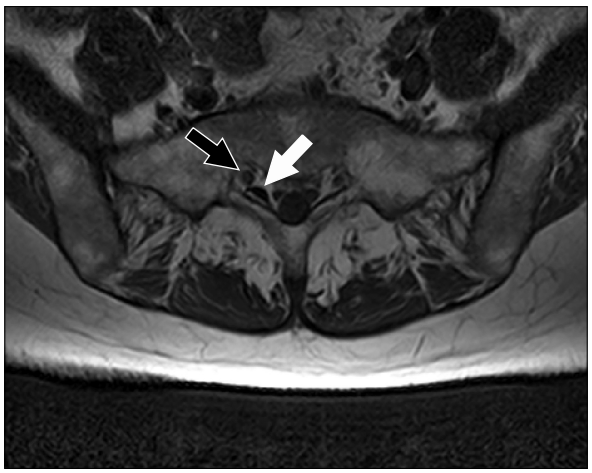

Fig. 1. MRI. T1-weighted MRI shows a low signal lesion, identified as an air bubble (white arrow) adjacent to the right S1 root (black arrow).

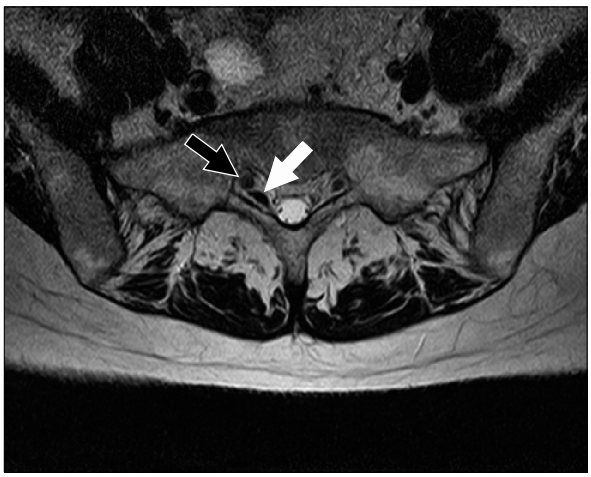

Fig. 2. MRI. T2-weighted MRI shows a low signal lesion, identified as an air bubble (white arrow) adjacent to the right S1 root (black arrow).

possibility of a hematoma caused by vessel injury, the patient underwent an MRI, which showed adjacent to the right S1 nerve root a 13-mm-long air bubble with a low signal intensity in both the T1- (Fig. 1) and T2- (Fig. 2) weighted images. A consultation with doctors from orthopedics and radiology was carried out, and based on the distribution of symptoms, the cause was agreed to be a space occupying lesion, probably an air bubble, near the right S1 root. The patient was put on close observation, and symptoms began improving spontaneously 7 hours post-procedure, with muscle strength reaching motor grade III for plantar flexion. Sensory function also improved to 40/100. After 24 hours post-procedure, the patient had almost completely recovered, with a motor grade of IV and sensory function of 80/100. Forty-eight hours after the initial procedure, motor and sensory functions were fully back to normal.

DISCUSSION

Administration of local anesthetics or steroids to the epidural space via the caudal approach is useful in the treatment of a variety of chronic benign pain syndromes, including lumbar radiculopathy, low back syndrome, spinal stenosis and pelvic pain syndromes [2]. Because of the simplicity, safety, and patient comfort associated with the caudal approach to the epidural space, this technique is beginning to replace the lumbar epidural approach for these indications in some pain centers [3]. In this case, however, within the first 1 hour after the caudal epidural injection, the patient showed symptoms of plantar flexion impairment in the right ankle and numbness of the right S1 dermatome, namely the posterolateral side of the lower leg and the plantar area of the foot.

Possible causes for neurologic complications after a caudal epidural injection include an inadvertent intrathecal injection, epidural abscess, and epidural hematoma [4]. First, in this case, inadvertent intrathecal injection seems unlikely for the following reasons; MRI showed a normal anatomy of the dural sac, with its extension limited to the first sacral vertebra; the needle was advanced inwards for only 2.5 cm; and no cerebrospinal fluid (CSF) appeared during the test aspiration. Furthermore, intrathecal injections have bilateral effects, whereas the patient's symptoms mainly persisted unilaterally. In such cases of unilateral motor weakness and numbness, the possible presence of a midline epidural septum may be considered [5]. However, the initial bilateral numbness that appeared 10 minutes post-procedure ruled out this possibility. Second, although rare, an epidural abscess is also capable of causing paraplegia or paralysis with vertebral pain, fever, and motor and sensory deficits. Nonetheless, it is reported in the literature that an average of 5 days are needed for the symptoms to manifest [4], which does not align with the details of our case. Finally, epidural hematoma, a rare but serious complication, can cause neurologic deficits that can remain permanent despite an emergency laminectomy [4]. Rapid diagnosis and treatment are crucial to counter its rapid progress. In the initial hours of our case, when the symptoms failed to improve, ruling out an epidural hematoma was crucial, providing the rationale for an emergency MRI study. Both the T1- (Fig. 1) and T2- (Fig. 2) weighted images showed a low signal lesion measuring 13 mm in the vicinity of the right S1 root. The MRI readings strongly suggested that the lesion was trapped epidural air rather than a hematoma. In the presence of epidural hematoma, the initial MRI findings during the first 12 hours are characterized by an almost equivalent signal in the T1-weighted MRI and a slightly high signal in the T2-weighted MRI [6]. However, the patient's 4-hour post-procedure MRI findings showed a low signal lesion in both the T1- and T2-weigted images. Hence, the possibility of a hematoma was ruled out.

With these possible causes ruled out, it was highly suspected that the patient's neurological symptoms were due to an air bubble trapped near the right S1 nerve root. Although no clear signs of direct nerve compression were seen, consulting doctors from orthopedics and radiology all agreed that an air bubble, as a space occupying lesion, was highly likely to account for the symptoms. This conclusion was based on the fact that previously nonexistent symptoms of right ankle plantar flexion impairment and S1 dermatome numbness appeared after the procedure, with manifestations similar to an S1 radiculopathy.

Epidural air can spread along the nerves of the paravertebral space, and, depending on its location, neurologic complications such as multiradicular syndrome, lumbar root compression, and even paraplegia can occur [7,8]. Kennedy et al. [8] reported a case of back pain and paraplegia due to an erroneous injection of massive air in the epidural space during continuous lumbar epidural infusion of opioids and local anesthetics to treat cancer pain.

Computed tomography (CT) showed the epidural space from L1 to L4 filled with air, with the thecal sac of the L2 and L3 levels severely compressed. After a spinal needle was introduced into the epidural space, removing 15 ml of air, the patient promptly recovered. Miguel et al. [9] reported a case with symptoms of sharp shooting pain, motor weakness, and paraplegia after using the loss of resistance to air technique for epidural anesthesia. The CT showed compression due to air trapping on the spinal nerve roots of the corresponding symptomatic dermatomes. There have also been reported cases of subcutaneous emphysema developing at the supraclavicular region after epidural anesthesia, commonly due to injection of more than 20 ml of air after multiple failures or difficult attempts to identify the epidural space [10]. Cuerden et al. [11] reported that in four obstetric patients, recovery was delayed due to neurologic symptoms such as numbness, paresthesia, muscle weakness, hypomyotonia, and decreased muscle reflexes following lumbar epidural anesthesia. All patients recovered within 48 hours. The authors concluded that air caught in the epidural space is absorbed within 24 to 48 hours, resulting in spontaneous resolution of the symptoms. This also was the case for our patient because her symptoms subsided within 48 hours.

Unlike the above reports, the volume of air used in our patient was minimal. However, it is highly likely that the air trapped in the right S1 nerve root was responsible for the unilateral motor weakness and the numbness of the S1 dermatome. Waldman [2] suggested the use of 1 ml of air for the air-acceptance test. Similarly, in our case, 1 ml of air was injected to find resistance, and then the needle was advanced 0.5 cm farther before the injection of an additional 1 ml. Thus, a total of 2 ml of air was used. With the aid of the Rapidia 2.8 program (INFINITT company, Seoul, Korea), the MRI-identified air bubble was measured to be 13 mm in length and 0.337 ml in volume and determined to be trapped near the right S1 nerve root.

Stevens et al. [12] investigated how air bubbles within the epidural space migrate around the nerve roots. They reported that air bubbles collect near the outlet space for the exiting nerve roots. Therefore, while a large amount of air injection may cause radiculopathy, even the smallest amount of air may show up on an MRI as a herniated disc [13].

Because epidural gas is absorbed spontaneously, the first line of treatment in patients with neurologic symptoms must be conservative, using nonsteroid anti-inflammatory drugs and muscle relaxants, along with close observation. Gas aspiration under fluoroscopic guidance can be considered; however, in our case, the gas volume was too small for the patient to undergo such a procedure. Surgery should be reserved for chronic encapsulated lesions not responding to conservative therapy [14].

To prevent complications from epidural air, only a minimal amount of air should be injected. Furthermore, the use of ultrasound or fluoroscopic guidance with contrasts can be considered as alternatives to the air-acceptance test [15].

In conclusion, using even a minute amount of air during caudal epidural injection can cause air trapping around a nerve root and induce neurologic complications. Hence, more precautions should be taken during such procedures.

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